

## ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือตรวจวัดและวิเคราะห์





THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

**Request No.** 21-67/0575

**MTC No.** EEL. BP. 15/0867

## CALIBRATION CERTIFICATE

**Submitted by** : TNP ENVIRONMENT CO.,LTD.

**Address** : 332/173 Moo 3 Bang Rak Phatthana, Bang Bua Tong, Nonthaburi 11110.

**Calibrated at** : Electrical and Electronic Standards Laboratory, Industrial Metrology and Testing Service Centre.  
Soi 1C, Bangpoo Industrial Estate, Sukhumvit Rd., Muang, Samutprakan 10280.

### Instrument Calibrated :

Description : Sound Calibrator

Manufacturer : KEPLER

Model : KSM-42C

Serial No. : 160100568

### Ambient Environment

Temperature :  $(23 \pm 3) ^\circ\text{C}$

Relative Humidity :  $(50 \pm 15) \%$

Ambient Pressure :  $(101.325 \pm 1.500) \text{ kPa}$

**Standards used :**

1. Digital Function Synthesizer NF Electronic DF-193A S/N 122037.
2. Measuring Amplifier Bruel&Kjaer 2636 S/N 1537484.
3. Programmable Attenuator Tamagawa TPA-303A S/N OF 2214.
4. Digital Multimeter Agilent 34401A S/N MY44005560.
5. Pressure Transmitter Vaisala PTB202AD S/N T0650001.
6. Audio Analyzer Panasonic VP-7722A S/N 041477D122.
7. Condenser Microphone B&K 4180 S/N 2633526.

**Calibration Procedure:** CP-102-04 based on IEC 60942-2003. The sound pressure level of instrument was measured by standard microphone using an insert voltage technique.

This instrument has been calibrated against standards maintained at Electrical and Electronic Standards Laboratory (EEL), which are traceable to the International System of Units through the National Institute of Metrology (Thailand).

The information on actual reading is attached herewith and the uncertainty limits quoted refer to the measured values only.

**Date of Receipt** : 6 Aug. 2024

**Date of Calibration** : 26 Aug. 2024

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The results relate only to the items tested/calibrated or value assigned.

Advertising the Report/Certificate and publicity of the results except in full are prohibited unless written permission is obtained from the governor of TISTR.

FM.BL.MTC.002 Rev.5

#### Head Office

35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9036  
Fax. (66) 0 2577 9009

#### Office/Laboratory

668 Mu 2 Tambon Bangpoomai, Amphoe Muang Samutprakan,  
Changwat Samutprakan 10280, Thailand  
Tel. (66) 0 2323 1672-80 ext. 115, 116  
(66) 08 3219 9440  
E-mail : mtc@tistr.or.th Website : www.tistr.or.th

#### Office

196 Phahonyothin Road, Ladyao, Chatuchak,  
Bangkok 10900, Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
(66) 08 1889 6827

THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

**Request No.** 21-67/0575

**MTC No.** EEL. BP. 15/0867

The reported expanded uncertainty is based upon a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%.

**Nominal Output of Unit Under Test = 94 dB re 20 $\mu$ Pa at 1000 Hz**

**Acoustic Output in dB re 20 $\mu$ Pa , Corrected to Reference Conditions : 101.325 kPa , 23.0°C and 50 %RH**

**1. Sound Pressure Level**

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	94.30	0.30	$\pm 0.10$	$\pm 0.75$ dB

**2. Frequency**

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	969.9	-30.1	$\pm 1.5$	$\pm 2.0\%$

**3. Total distortion**

Standard Microphone Type	Measured Total distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Bruel&Kjaer 4180	1.70	$\pm 0.50$	$\pm 4.0\%$

**Note :** 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

**Date of Calibration** : 26 Aug. 2024

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THAILAND INSTITUTE OF SCIENTIFIC AND TECHNOLOGICAL RESEARCH (TISTR)

Request No. 21-67/0575

MTC No. EEL. BP. 15/0867

Nominal Output of Unit Under Test = 114 dB re 20 $\mu$ Pa at 1000 Hz

Acoustic Output in dB re 20 $\mu$ Pa , Corrected to Reference Conditions : 101.325 kPa , 23.0 °C and 50 %RH

1. Sound Pressure Level

Standard Microphone Type	Measured Sound Pressure Level (dB)	Deviated value (dB)	Uncertainty (dB)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	114.33	0.33	$\pm 0.10$	$\pm 0.75$ dB

2. Frequency

Standard Microphone Type	Measured Frequency (Hz)	Deviated value (Hz)	Uncertainty (Hz)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	965.6	-34.4	$\pm 1.5$	$\pm 2.0\%$

3. Total Distortion

Standard Microphone Type	Measured Total Distortion (%)	Uncertainty (%)	Tolerance limit IEC60942:2003 Class 2
1/2 inch Brüel&Kjaer 4180	2.15	$\pm 0.50$	$\pm 4.0\%$

Note : 1. No adjustment.

2. The calibrator pressure correction was not included.

3. The microphone volume correction was not included.

Calibrated by :



Approved



Electrical and Electronic Standards Laboratory

Industrial Metrology and Testing Service Centre

Date of Calibration : 26 Aug. 2024

Date of Issue : 27 Aug. 2024

Ref : 2011167080602911001

End of Certificate

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FM.BL.MTC.002 Rev.5

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35 Mu 3 Tambon Khlong Ha, Amphoe Khlong Luang,  
Changwat Pathumthani 12120, Thailand  
Tel. (66) 0 2577 9036  
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196 Phahonyothin Road, Ladyao, Chatuchak,  
Bangkok 10900, Thailand  
Tel. (66) 0 2579 1121-30 ext. 5219, 5225, 5217  
(66) 08 1889 6827



**SMART TECH CALIBRATION & SERVICES CO., LTD.**

14/506 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,  
THANYABURI, PATHUM THANI 12110, THAILAND

Tel. +662-114-3148 Email : stcal.md@gmail.com Website : stc-cal.com

**Certificate of Calibration**

**Certificate No.** STCR-2407094-3

**Work Order No.** STCR-2407094

Page 1 of 3

**Customer Name** : TNP Environment Co., Ltd.  
332/173 Vision Smart Life Village, Bang Rak Pattana Subdistrict,  
Bang Bua Thong District, Nonthaburi Province 11110

**Equipment Name** : Sound Level Meter  
**Manufacturer** : SCARLET  
**Model** : ST-25D  
**Serial Number** : 10340948  
**Control Number** : TNP-F-S29  
**Received Date** : Jul 1, 2024  
**Calibration Date** : Jul 1, 2024  
**Recommended Due Date** : Jul 1, 2025  
**Calibration Method** : Calibration Procedure No. CPE-04-01

**Environmental Conditions**  
**Ambient Temperature** :  $(25 \pm 2) ^\circ\text{C}$   
**Ambient Relative Humidity** :  $(50 \pm 15) \% \text{RH}$   
**Calibration Place** : Permanent Calibration Laboratory

**Condition as received** : Normal  
**Calibration Result** : See data attached

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
3. The working standard is indicated in page 2 of this certificate.
4. This report applies to the item calibrated and shall not be reproduced except in full, without written approval by Calibration Laboratory, Smart Tech Calibration & Services Co., Ltd.
5. This results of this report only to the items calibrated.

**Date of Issue** : Jul 1, 2024

**Approved by :**

**Calibrated by** :



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# Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2407094-3

Page 2 of 3

## Standards Equipment Used

<u>Equipment Name</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>	<u>Traceability to</u>
Sound Calibrator	N975185	5523631030478623	Nov 9, 2024	MP-TH

## Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



# Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2407094-3

Page 3 of 3

UUC Range : (30 to 130) dB

Resolution : 0.1 dB

Results of Calibration: [ ☒ ] Without adjustment [ ☐ ] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz

Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	94.0 dB	-	0.09 dB	0.40 dB
	114.07 dB	114.0 dB	-	0.07 dB	0.40 dB
SLOW	94.09 dB	94.0 dB	-	0.09 dB	0.40 dB
	114.07 dB	114.0 dB	-	0.07 dB	0.40 dB

Sound Level Calibration @ Frequency 1 kHz

Select : C

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	94.0 dB	-	0.09 dB	0.40 dB
	114.07 dB	113.9 dB	-	0.17 dB	0.40 dB
SLOW	94.09 dB	94.0 dB	-	0.09 dB	0.40 dB
	114.07 dB	113.9 dB	-	0.17 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -





**SMART TECH CALIBRATION & SERVICES CO., LTD.**

14/506 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,  
THANYABURI, PATHUM THANI 12110, THAILAND

Tel. +662-114-3148 Email : stcal.md@gmail.com Website : stc-cal.com



## Certificate of Calibration

**Certificate No.** STCR-2407094-5

**Work Order No.** STCR-2407094

Page 1 of 3

**Customer Name** : TNP Environment Co., Ltd.  
332/173 Vision Smart Life Village, Bang Rak Pattana Subdistrict,  
Bang Bua Thong District, Nonthaburi Province 11110

**Equipment Name** : Sound Level Meter  
**Manufacturer** : SCARLET  
**Model** : ST-25D  
**Serial Number** : 10340946  
**Control Number** : TNP-F-S31  
**Received Date** : Jul 1, 2024  
**Calibration Date** : Jul 1, 2024  
**Recommended Due Date** : Jul 1, 2025  
**Calibration Method** : Calibration Procedure No. CPE-04-01

**Environmental Conditions**

**Ambient Temperature** :  $(25 \pm 2) ^\circ\text{C}$   
**Ambient Relative Humidity** :  $(50 \pm 15) \% \text{RH}$   
**Calibration Place** : Permanent Calibration Laboratory

**Condition as received** : Normal

**Calibration Result** : See data attached

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
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5. This results of this report only to the items calibrated.

**Date of Issue** : Jul 1, 2024

**Approved by :**

**Calibrated by** :



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# Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2407094-5

Page 2 of 3

**Standards Equipment Used**

<u>Equipment Name</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>	<u>Traceability to</u>
Sound Calibrator	N975185	5523631030478623	Nov 9, 2024	MP-TH

**Traceability**

This calibration is traceable to the International System of Unit via :  
- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.





# Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2407094-5

Page 3 of 3

UUC Range : (30 to 130) dB

Resolution : 0.1 dB

Results of Calibration: [ ☒ ] Without adjustment [ ☐ ] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz

Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	94.0 dB	-	0.09 dB	0.40 dB
	114.07 dB	114.1 dB	-	-0.03 dB	0.40 dB
SLOW	94.09 dB	94.1 dB	-	-0.01 dB	0.40 dB
	114.07 dB	114.1 dB	-	-0.03 dB	0.40 dB

Sound Level Calibration @ Frequency 1 kHz

Select : C

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	94.1 dB	-	-0.01 dB	0.40 dB
	114.07 dB	114.0 dB	-	0.07 dB	0.40 dB
SLOW	94.09 dB	94.1 dB	-	-0.01 dB	0.40 dB
	114.07 dB	114.0 dB	-	0.07 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -



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14/506 MOO 3, RANGSIT-NAKHON NAYOK ROAD, LAM PHAK KUT,  
THANYABURI, PATHUM THANI 12110, THAILAND

Tel. +662-114-3148 Email : stcal.md@gmail.com Website : stc-cal.com



## Certificate of Calibration

Certificate No. STCR-2407092-1

Work Order No. STCR-2407092

Page 1 of 3

**Customer Name** : TNP Environment Co., Ltd.  
332/173 Vision Smart Life Village, Bang Rak Pattana Subdistrict,  
Bang Bua Thong District, Nonthaburi Province 11110

**Equipment Name** : Sound Level Meter  
**Manufacturer** : SCARLET  
**Model** : ST-25D  
**Serial Number** : 10340945  
**Control Number** : TNP-F-S25  
**Received Date** : Jul 4, 2024  
**Calibration Date** : Jul 5, 2024  
**Recommended Due Date** : Jul 5, 2025  
**Calibration Method** : Calibration Procedure No. CPE-04-01

**Environmental Conditions**

**Ambient Temperature** :  $(25 \pm 2) ^\circ\text{C}$   
**Ambient Relative Humidity** :  $(50 \pm 15) \% \text{RH}$   
**Calibration Place** : Permanent Calibration Laboratory

**Condition as received** : Normal

**Calibration Result** : See data attached

1. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor  $k = 2$ , providing a level of confidence of approximately 95%.
2. The Unit Under Calibration (UUC) has been calibrated by using the working standard which is traceable to SI-Units. The calibration procedure documented is intended to implement the requirements of ISO/IEC 17025 : 2017
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5. This results of this report only to the items calibrated.

**Date of Issue** : Jul 5, 2024

**Calibrated by** :

**Approved by :**



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# Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2407092-1

Page 2 of 3

## Standards Equipment Used

<u>Equipment Name</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due Date</u>	<u>Traceability to</u>
Sound Calibrator	N975185	5523631030478623	Nov 9, 2024	MP-TH

## Traceability

This calibration is traceable to the International System of Unit via :

- MP-TH : Micro Precision Calibration Laboratory (Thailand) Co., Ltd.



# Calibration Report

Smart Tech Calibration & Services Co., Ltd.

Certificate No.: STCR-2407092-1

Page 3 of 3

UUC Range : (30 to 130) dB

Resolution : 0.1 dB

Results of Calibration: [ ] Without adjustment [ ☒ ] With adjustment

Appearance and Function of Use Inspection : GOOD

Sound Level Calibration @ Frequency 1 kHz

Select : A

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	93.2 dB	94.1 dB	-0.01 dB	0.40 dB
	114.07 dB	113.1 dB	114.0 dB	0.07 dB	0.40 dB
SLOW	94.09 dB	93.2 dB	94.1 dB	-0.01 dB	0.40 dB
	114.07 dB	113.1 dB	113.9 dB	0.17 dB	0.40 dB

Sound Level Calibration @ Frequency 1 kHz

Select : C

Response times	STD. Value	UUC. Reading		Correction	(±) Uncertainty
		Before Adjustment	After Adjustment		
FAST	94.09 dB	93.2 dB	94.1 dB	-0.01 dB	0.40 dB
	114.07 dB	113.1 dB	114.0 dB	0.07 dB	0.40 dB
SLOW	94.09 dB	93.2 dB	94.1 dB	-0.01 dB	0.40 dB
	114.07 dB	113.2 dB	114.0 dB	0.07 dB	0.40 dB

STD = Standard

UUC = Unit Under Calibration

- End of Certificate -







# CERTIFICATE OF CALIBRATION

NO. 20240325034

Name of Product:	Sound Level Meter
Model	ST-25D
Manufacturer:	Scarlet Tech Co., Ltd.
Serial Number:	10340909
Specification:	Class 2
Conclusion:	Pass
Date of calibration:	2024-03-25
Due Date:	2025-03-24

Calibrated by:

- This report certifies that all calibration equipment used in the test is traceable with the internal ISO9001 procedures and meets all specification given in the Manual(s) or respectively surpass then, and applies only to the unit identified above.
- This certificate is produced with advanced equipment & procedures which permit comprehensive quality assurance verification of all data supplied herein.
- This certificate of calibration shall not be reproduced except in full, without written permission of the Scarlet Tech Co Ltd Taiwan.

1. Preliminary inspection: OK

2. Type & serial No. of Microphone: AWA14421-A000155

3. Adjustments to indicated sound levels:

Type of Calibrator: B&K 4231

Sound Pressure Level: 94.0 dB

4. Measuring up limit: 138 dBA

5. Frequency weightings (Acoustic signal tests for Z weighting, other electric signal tests.)

Equivalent Free-field Sound Level (reference environment conditions) 93.8 dB

Nominal frequency /Hz	Frequency weighting / dB			Nominal frequency /Hz	Frequency weighting / dB		
	A	C	Z		A	C	Z
20	-50.7	-6.3	0.3	1000	0.0	0.1	0.0
31.5	-39.6	-3.1	0.1	2000	1.3	-0.1	-0.1
63	-26.3	-0.9	0.1	4000	1.1	-0.7	-0.1
125	-16.2	-0.1	0.0	8000	-1.0	-2.8	-0.1
250	-8.7	0.0	0.0	12500	-4.1	-5.9	-0.1
500	-3.3	0.1	0.0	/	/	/	/



#### 6. Self-generated noise

Microphone installed: 42.1 dBA

Microphone replaced by electrical input signal device

23.0 dB(A)	36.8 dB(C)	43.8 dB(Z)
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#### 7. F&S Weighting

Rate of the F weighting decrease (dB/s)	33.7
Rate of the S weighting decrease (dB/s)	4.3
Deviation of F&S	0.0

#### 8. Level Linearity (A-weighting at frequency 1 kHz)

(Total measuring range: 33 dBA - 138 dBA, frequency 1 kHz)

Reference level range (frequency 1 kHz):

① 10 dB Interval

Signal	37.0	44.0	54.0	64.0	74.0	84.0	94.0	104.0	114.0	124.0	134.0
Indicating value dB(A)	37.0	44.0	54.0	64.0	74.0	84.1	94.0	103.9	114.0	124.2	134.1
Full scale deviation (dB)	0.0	0.0	0.0	0.0	0.0	0.1	0.0	-0.1	0.0	0.2	0.1

Max error at 10 dB Interval 0.2 dB

① 1 dB Interval

Upper Limit	134.0	135.0	136.0	137.0	138.0
Indicating value dB(A)	134.1	135.2	136.2	137.2	138.0
Full scale deviation (dB)	0.1	0.2	0.2	0.2	0.0
Lower Limit	33.0	34.0	35.0	36.0	37.0
Indicating value dB(A)	33.2	34.1	35.0	36.1	37.0
Full scale deviation (dB)	0.2	0.1	0.0	0.1	0.0

Max error at 10 dB Interval 0.2 dB

#### 9. Tone burst response (A Weighting)

Single Toneburst duration /ms	Toneburst response /dB			
	LAFmax-LA	LASmax-LA	LAE-LA	LAeqT-LA
500	-0.1	-4.0	-3.1	-7.0
200	-1.0	-7.5	-7.0	-7.0
2	-18.0	-27.1	-27.1	-7.1
0.25	-27.1	/	-36.1	-7.1

10. Overload indication: Pass

# 11. Peak C sound level (500Hz) :

Number of cycles in test signals	Nominal frequency of test signal/Hz	(LCpeak-LC)/dB		Tolerance limits : Class2/dB
		Reference level range	Reference difference	
		4dB low of upper limit		
one	31.5	3.0	2.5	±3.0
one	500	3.6	3.5	±2.0
one	8000	3.5	3.4	±3.0
Positive half cycle	500	2.2	2.4	±2.0
Negative half cycle	500	2.3	2.4	±2.0

# 12. Statistical analysis function

indicated sound level of sweep signal maximum: 120 dB

Sweep amplitude: 40 dB

Measurement period: 60 S; Measurement duration: 180 S.

Index	(dB)		
	SLM Reading	Expected Reading	Deviation
LAeq, T	110.4	110.4	0.0
L5	118.0	118.0	0.0
L10	116.0	116.0	0.0
L50	99.9	100.0	-0.1
L90	84.0	84.0	0.0
L95	82.0	82.0	0.0

Uncertainty of measurement results: 0.4 dB (k=2)

# 13. SD card function: Pass

## References:

IEC 61672-1:2013 Electroacoustics-Sound Level Meters - Part 1 : Specifications

IEC 61260-1:2014 Electroacoustics-Octave-band and fractional-octave-band filters - Part 1 : Specifications

IEC 61252:2017 Electroacoustics-Specifications for personal sound exposure meters

## Environment conditions:

Air temperature: 20 °C Relative humidity: 50 % Static pressure: 101.8 kPa



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd.  
63/14-15, 67/35-36  
Petchkasem 7,7/1, Rd. Watthapra, Bangkokyai,  
Bangkok 10600 (Thailand)  
Tel: +6608680812  
Mobile: +66863999453  
E-mail: jnac-calibration@jiranatee.com  
Web site: www.jiranatee.com

Accredited calibration laboratory  
ISO/IEC 17025:2017  
NSC-TISI-TIS 17025  
CALIBRATION 0367

Flow measurement laboratory  
Calibration services department.



## CERTIFICATE OF CALIBRATION

Certificate No. : COF-044-67

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice  
MANUFACTURER : TISCH  
MODEL/TYPE : TE-5028  
SERIAL NUMBER : 3945  
ID NUMBER : TNP-F-CAL02  
CONDITION AS-RECEIVED : Used item  
CUSTOMER : TNP Environment Co., Ltd.  
332/173 Vision Smart Life Village, Bangrak Phatthana,  
Bang Bua Thong District, Nonthaburi 11110

RECEIVED DATE : 29 Oct 2024  
MEASUREMENT DATE : 30 Oct 2024  
ISSUE DATE : 30 Oct 2024

### ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature	: $23.0 \pm 3.0$	°C
Relative Humidity	: $55.0 \pm 15.0$	%RH
Atmospheric Pressure	: $1010 \pm 10$	hPa

### CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.  
Measurement Condition : The average values during measurement are 23.9 °C and 55.8 %RH.

### Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp. The WI-CL-004 was used as a calibration guideline.

### Traceability:

This certificate provides a traceability of the measurement to recognized the national standards, and to realization of the international system of units (SI) through the NIMT (National Metrology Institute of Thailand) via Certificate number: MW-0063-23.

### Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor  $k=2$ , Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

**NOTED:** The certificate is valid only to the item calibrated on date and place of calibration.

### TABULATION OF RESULTS:

The table on next page give the measured values.

Calibrated by:



JIRANATEE ASSOCIATES CO.,LTD.

Continuation of Certificate of Calibration Number COF-044-67

Page 2 of 2 Pages

#### MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25°C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of  $Q$  Standard calibration data

Plate	Flow rate $\text{m}^3/\text{min}$	Pressure [Pa] mmHg	Temperature [Ta] $^{\circ}\text{C}$	Temperature [Tm] $^{\circ}\text{C}$	$\Delta p_{\text{meter}}$ mmHg	$\Delta p_{\text{Orifice}}$ inH <sub>2</sub> O	$\gamma$	Standard Flow [ $Q_s$ ] $\text{m}^3/\text{min}$
1	0.703	758.163	23.78	22.67	49.921	1.158	1.077	0.660
2	0.999	758.204	23.26	22.30	35.795	2.480	1.577	0.959
3	1.117	758.225	23.29	22.38	30.579	3.143	1.776	1.079
4	1.164	758.281	23.31	22.57	28.519	3.425	1.854	1.127
5	1.414	758.199	23.33	22.86	18.318	5.237	2.292	1.387

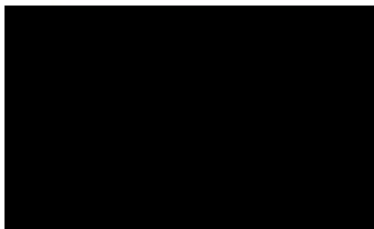
Slope ( $m$ ): 1.66978  
Intercept ( $b$ ): -0.02500  
Correlation coefficient ( $r$ ): 0.99989  
Uncertainty ( $k=2$ ): 0.015  $\text{m}^3/\text{min}$

Table 2: The results of  $Q$  actual calibration data

Plate	Flow rate $\text{m}^3/\text{min}$	Pressure [Pa] mmHg	Temperature [Ta] $^{\circ}\text{C}$	Temperature [Tm] $^{\circ}\text{C}$	$\Delta p_{\text{meter}}$ mmHg	$\Delta p_{\text{Orifice}}$ inH <sub>2</sub> O	$\gamma$	Standard Flow [ $Q_s$ ] $\text{m}^3/\text{min}$
1	0.703	758.163	23.78	22.67	49.921	1.158	0.673	0.659
2	0.999	758.204	23.26	22.30	35.795	2.480	0.985	0.955
3	1.117	758.225	23.29	22.38	30.579	3.143	1.109	1.075
4	1.164	758.281	23.31	22.57	28.519	3.425	1.157	1.123
5	1.414	758.199	23.33	22.86	18.318	5.237	1.431	1.382

Slope ( $m$ ): 1.04588  
Intercept ( $b$ ): -0.01565  
Correlation coefficient ( $r$ ): 0.99989  
Uncertainty ( $k=2$ ): 0.015  $\text{m}^3/\text{min}$

\*\*\*End of Certificate of Calibration\*\*\*



# CERTIFICATE OF CALIBRATION

## FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM19129/UM19129  
CLID. NO. : 252402965  
JOB CONTROL NO. : 241212132656  
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : TNP ENVIRONMENT CO., LTD.  
332/173 MOO 3 TAMBON BANG RAK PHATTANA,  
AMPHOE BANG BUA THONG, NONTABURI 11110

DATE OF RECEIVED : 12 December 2024

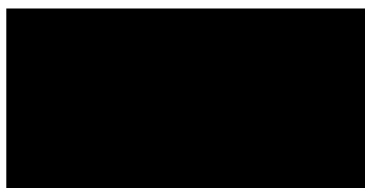
DATE OF ISSUED : 19 December 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :



Approved By :



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the  
International System of Units (SI)

Certificate No. Q24132656

F3-011-05/12-23

page 1 of 4



# REPORT OF CALIBRATION

## FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	721A2601/721A3301
SERIAL NO.	:	UM19129/UM19129
DATE OF CALIBRATION	:	13 December 2024

---

### ENVIRONMENT CONDITIONS :

Temperature :  $(23 \pm 2) ^\circ\text{C}$

Relative Humidity :  $(55 \pm 15) \% \text{RH}$

### PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter, Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

### REFERENCE STANDARD USED :

1. Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
2. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
3. Digital Multimeter, Keysight Technologies Model 3458A S/N. MY59352733.

### TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-24, Due Date 19 July 2025.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0050/24 , Due Date 13 May 2025 .
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0060-24, Due Date 26 June 2025.

### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2,00$  which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. **Q24132656**

F3-011-05/12-23

page 2 of 4

**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

**CALIBRATION DATA**

**1. VELOCITY RESULT**

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
( mm/s )	( frequency )		( mm/s )	( mm/s )	( mm/s )	$\pm$ ( % of rdg. )
10	80 Hz	peak	10.000	10.077	-0.077	1.5
20	80 Hz		20.000	20.149	-0.149	1.5
30	80 Hz		30.000	30.188	-0.188	1.5
40	80 Hz		40.000	40.242	-0.242	1.5
50	80 Hz		50.000	50.294	-0.294	1.5

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 2 of 67



# Calibration Certificate

Part Number: 721A2601  
Description: Micromate with DIN Geophone  
Serial Number: UM22388  
Calibration Date: APR 29 2024  
Calibration Reference Equipment: 714J7402

*Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.*

*Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.*

*The environment in which this product was calibrated is maintained within the operating specifications of the instrument.*

*Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.*

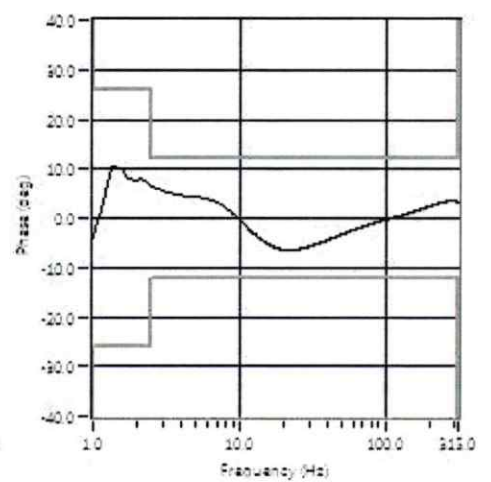
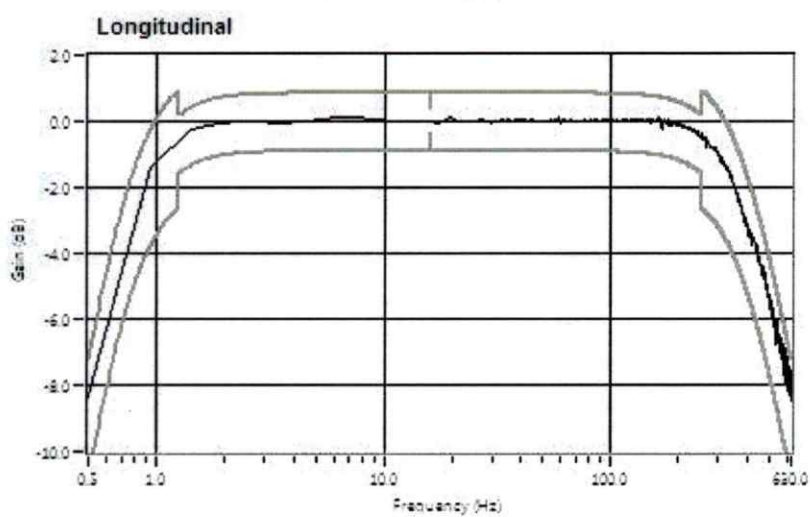
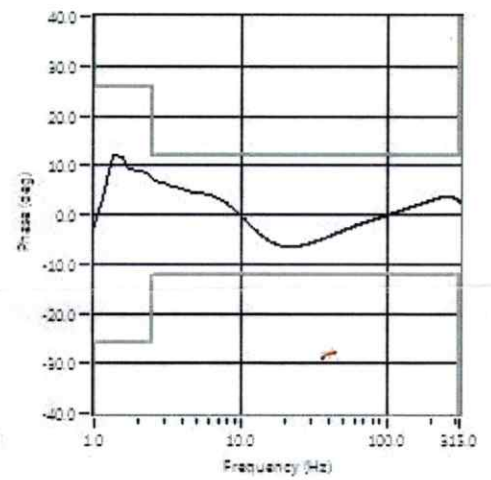
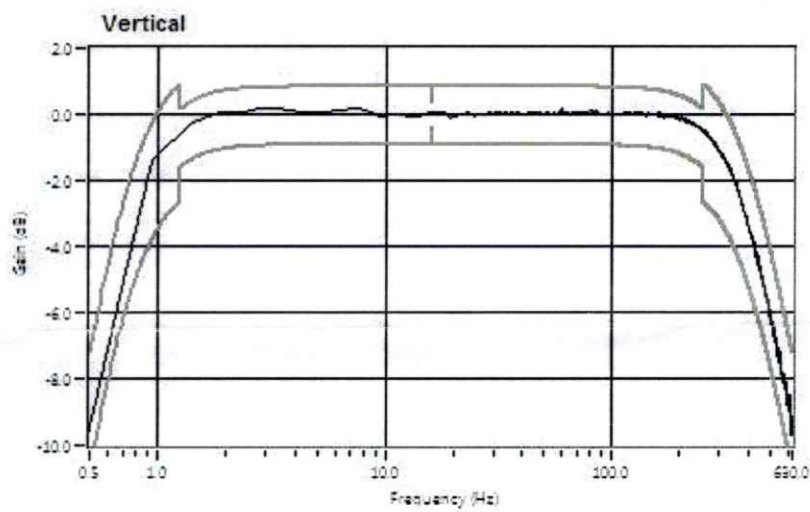
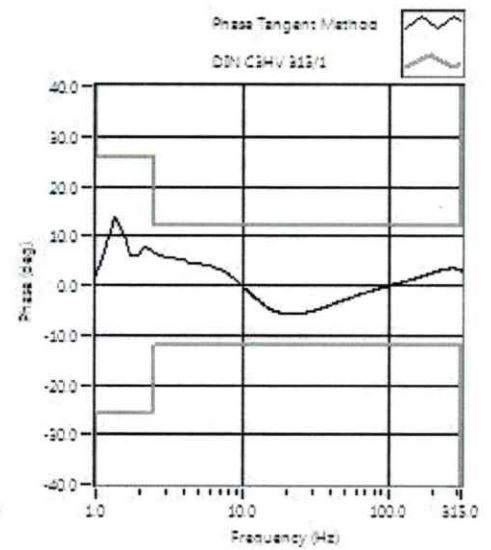
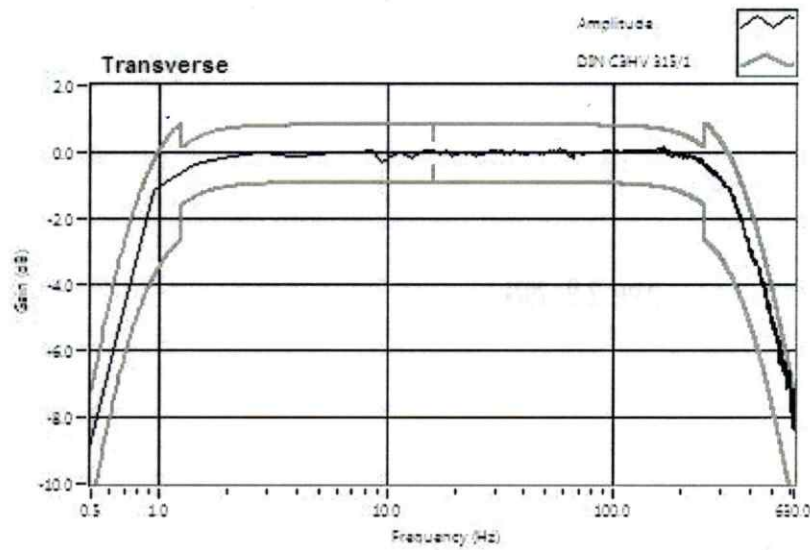
Calibrated By: \_\_\_\_\_



309 Legget Drive, Ottawa, Ontario, K2K 3A3, (613) 592-4642



# Frequency Response of UM22388





# CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM14102/UM14102  
CLID. NO. : 252100393  
JOB CONTROL NO. : 241101116709  
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

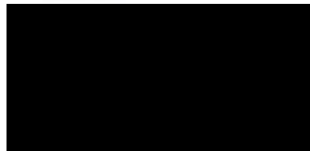
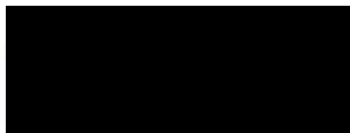
CUSTOMER : TNP ENVIRONMENT CO., LTD.  
332/173 MOO 3 TAMBON BANG RAK PHATTANA,  
AMPHOE BANG BUA THONG, NONTHABURI 11110

DATE OF RECEIVED : 01 November 2024

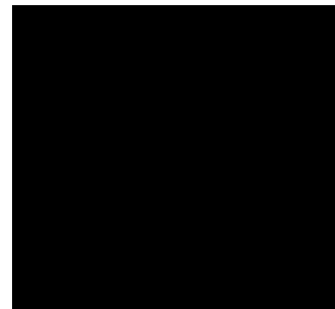
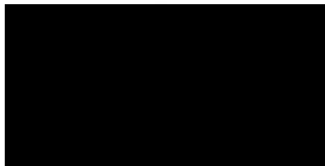
DATE OF ISSUED : 06 November 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :



Approved By :



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the  
International System of Units (SI)

Certificate No. Q24116709

F3-011-05/12-23

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@clccalibration





# CALIBRATION LABORATORY CO., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



## REPORT OF CALIBRATION

### FOR

**NOMENCLATURE** : **VIBRATION METER**  
**MANUFACTURER** : **INSTANTEL**  
**MODEL / TYPE** : **721A2601/721A3301**  
**SERIAL NO.** : **UM14102/UM14102**  
**DATE OF CALIBRATION** : **04 November 2024**

#### ENVIRONMENT CONDITIONS :

**Temperature :**  $(23 \pm 2) ^\circ\text{C}$

**Relative Humidity :**  $(55 \pm 15) \% \text{RH}$

#### PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter, Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

1. Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
2. Digital Multimeter, Hewlett Packard Model 34401A S/N. 3146A75935.
3. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.

#### TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-24, Due Date 19 July 2025.
2. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0130-23, Due Date 29 November 2024.
3. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0050/24 , Due Date 13 May 2025 .

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2,00$  which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

**Certificate No. Q24116709**

**F3-011-05/12-23**

page 2 of 4



@clccalibration

**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

## CALIBRATION DATA

### 1. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
( mm/s )	( frequency )		( mm/s )	( mm/s )	( mm/s )	± ( % of rdg. )
10	80 Hz	peak	10.000	10.097	-0.097	1.5
20	80 Hz		20.000	20.188	-0.188	1.5
30	80 Hz		30.000	30.256	-0.256	1.5
40	80 Hz		40.000	40.365	-0.365	1.5
50	80 Hz		50.000	50.421	-0.421	1.5

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 2 of 67



## CALIBRATION DATA

### \*2. FREQUENCY RESULT

STD Applied ( Hz )	DUC Reading ( Hz )	Correction ( Hz )	Uncertainty $\pm$ ( Hz )
50	50	0	0.6
80	79	+1	0.6
100	100	0	0.6

Note. \* means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

**This report is valid for the above stated instrument/s only.**

### End of Certificate ###

Certificate No. Q24116709

F3-011-05/12-23

page 4 of 4



@clccalibration



# CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



## CERTIFICATE OF CALIBRATION FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM19244/UM19244  
CLID. NO. : 252402113  
JOB CONTROL NO. : 240919100992  
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

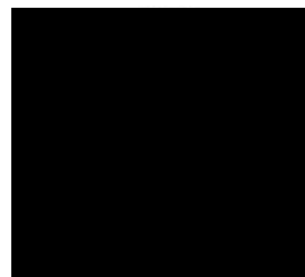
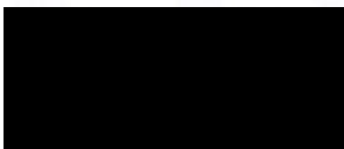
CUSTOMER : TNP ENVIRONMENT CO., LTD.  
332/173 MOO 3 TAMBON BANG RAK PHATTANA,  
AMPHOE BANG BUA THONG, NONTHABURI 11110

DATE OF RECEIVED : 19 September 2024

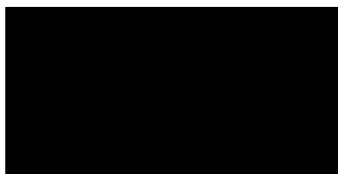
DATE OF ISSUED : 28 September 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :



Approved By :



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the  
International System of Units (SI)

Certificate No. Q24100992

F3-011-05/12-23

page 1 of 4



@clccalibration





# CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230

Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



## REPORT OF CALIBRATION FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM19244/UM19244  
DATE OF CALIBRATION : 26 September 2024

### ENVIRONMENT CONDITIONS :

Temperature :  $(23 \pm 2) ^\circ\text{C}$

Relative Humidity :  $(55 \pm 15) \% \text{RH}$

### PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter, Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

### REFERENCE STANDARD USED :

1. Digital Multimeter, Hewlett Packard Model 34401A S/N. 3146A75935.
2. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2626 S/N. 705491, 1741406.

### TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0130-23, Due Date 29 November 2024.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0050/24 , Due Date 13 May 2025 .
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0053-23, Due Date 12 October 2024.

### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2,00$  which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. **Q24100992**

**F3-011-05/12-23**





**CLC**  
Accredited  
ISO/IEC 17025

# CALIBRATION LABORATORY Co., LTD.

2/10-11,14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

## CALIBRATION DATA

### 1. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
( mm/s )	( frequency )		( mm/s )	( mm/s )	( mm/s )	± ( % of rdg. )
10	80 Hz	peak	10.000	10.089	-0.089	1.6
20	80 Hz		20.000	20.156	-0.156	1.1
30	80 Hz		30.000	30.196	-0.196	1.0
40	80 Hz		40.000	40.256	-0.256	0.9
50	80 Hz		50.000	50.311	-0.311	0.9

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 2 of 67

Certificate No. Q24100992

F3-011-05/12-23

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@clccalibration



**CLC**  
Accredited  
ISO/IEC 17025

# CALIBRATION LABORATORY Co., LTD.

2/10-11,14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230  
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



## CALIBRATION DATA

### \*2. FREQUENCY RESULT

STD Applied ( Hz )	DUC Reading ( Hz )	Correction ( Hz )	Uncertainty $\pm$ ( Hz )
50	50	0	0.8
80	80	0	0.8
100	100	0	0.8

Note. \* means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

**This report is valid for the above stated instrument/s only.**

**### End of Certificate ###**

Certificate No. Q24100992

F3-011-05/12-23

page 4 of 4



@clccalibration



# THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

## Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 1 April, 2024

Certification No. 188/24

Page : 1 of 2

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WL-21

Serial No. : Wireless Receiver 2112DR0074 ID No. : TNP-F-W03

Wind Sensor 2112DT0074

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo 3 T.Bang Rak Phatthana,

A.Bang Bua Thong, Nonthaburi 11110.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.9 hPa

### NATIONAL STANDARD WIND TUNNEL :

: Micromanometer Theodor Friedrichs FC014 Serial No. 9310119

: HOOK GAGE NO 1425 Pitot Tube Theodor Friedrichs Type 0800.0000 serial 9023

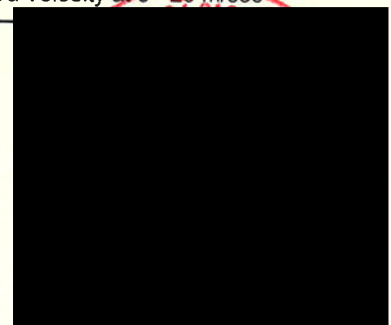
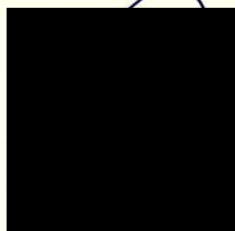
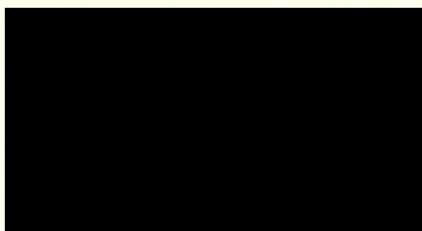
N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

: Standard Velocity at 0 - 20 m/sec







# THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

## The Result of Calibration

Certification No. 188/24

1 April, 2024

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacumm inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	4.9	0.10
7.00	-	-	-	7.0	0.00
9.02	-	-	-	9.0	0.02
11.01	-	-	-	11.0	0.01
13.01	-	-	-	12.9	0.11
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.1	-0.08
-	0.754	0.751	25.03	25.3	-0.27
-	1.083	1.083	30.03	30.5	-0.47

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	



ID LINE : IEC17025



## Certificate of Calibration

Certificate Number : SPR24050187-1

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi  
11110

Equipment Name : Autoclave

Manufacturer : BIOBASE

Model : BKQ-Z50I

Serial Number : BKQ-Z50I23055014

ID. Number : TNP.LAB.56

### Environmental Conditions

Ambient Temperature :  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$

Relative Humidity :  $60\% \pm 20\%$

Location of Calibration : On-Site

Calibration Procedure : SP-CPT-04-04

Received Date : 11 May 2024

Calibration Date : 16 May 2024

Recommend Due Date : 16 May 2025

Date of Issue : 17 May 2024

### Method of Calibration

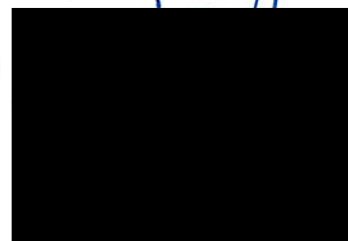
This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Approved by :





ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24050187-1

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Data Acquisition/Switch Unit	34970A	MY44074688	SPR24010142-25	11 Jan 2025

### Traceability

This certification is traceable to the International System of Unit maintained at :  
SP Metrology - SP Metrology system (Thailand) Co.Ltd.





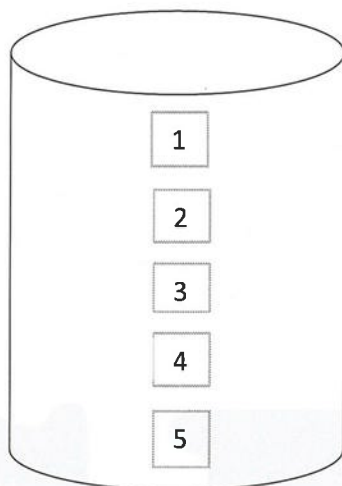
ID LINE : IEC17025



## Result of Calibration

Certificate Number : SPR24050187-1

Page : 3 of 3



### 1. Temperature Accuracy in the Measurement Zone.

Unit : °C

UUC Setting	Measured Temperature (°C) @ Probe No.					Uncertainty ( ± )
	# 1	# 2	# 3	# 4	# 5	
115.0	115.1	115.0	115.1	115.0	115.1	0.26
121.0	121.1	121.0	121.0	121.1	121.1	0.26

### 2. Temperature Uniformity, Stability

Unit : °C

UUC Setting	UUC Reading	Temperature Stability	Temperature Uniformity
115.0	115.0	0.02	0.04
121.0	121.0	0.02	0.04

#### Note :

The result of calibration was found accurate as show on date and place of calibration only.  
This Certificate is not certified for any commercial transaction.

#### Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95 %

- End of Certificate -





ID LINE : IEC17025



## Certificate of Calibration

Certificate Number : SPR24050187-2

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi  
11110

Equipment Name : pH Meter

Manufacturer : Eutech

Model : pH 700

Serial Number : 3178920

ID. Number : TNP.LAB.57

### Environmental Conditions

Ambient Temperature :  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$

Relative Humidity :  $60\% \pm 20\%$

Location of Calibration : On-Site

Calibration Procedure : SP-CPC-04-01

Received Date : 11 May 2024

Calibration Date : 16 May 2024

Recommend Due Date : 16 May 2025

Date of Issue : 17 May 2024

### Method of Calibration

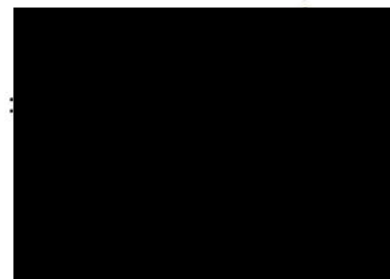
This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Approved by :





ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24050187-2

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Standard pH Solution	PH016.L5	Lot No.970880	61278486	25 Apr 2025
Standard pH Solution	PH107.L5	Lot No.970881	61281486	25 Apr 2025
Standard pH Solution	PH020.L5	Lot No.970882	61297722	25 Apr 2025

### Traceability

This certification is traceable to the International System of Unit maintained at :  
C.P.A. Chem - ANAB#AT-1836 (ISO/IEC 17025:2017) and ANAB#AR-1835 (ISO/IEC  
17034:2016)



ID LINE : IEC17025



## Result of Calibration

Certificate Number : SPR24050187-2

Page : 3 of 3

Range : 0 to 14 pH

Resolution : 0.01 pH

pH Measurement @ 25 °C

Unit : pH

Standard Solution	UUC Reading	Error	Uncertainty ( ± )
4.008	4.03	0.022	0.012
6.984	7.00	0.016	0.012
10.011	9.96	-0.051	0.013

### Note :

The result of calibration was found accurate as show on date and place of calibration only.  
This Certificate is not certified for any commercial transaction.

### Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95%.

- End of Certificate -





ID LINE : IEC17025



## Certificate of Calibration

Certificate Number : SPR24050187-3

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi  
11110

Equipment Name : Water Bath

Manufacturer : Memmert

Model : WTB24

Serial Number : LD23.0297

ID. Number : TNP.LAB.58

### Environmental Conditions

Ambient Temperature :  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$

Relative Humidity :  $60\% \pm 20\%$

Location of Calibration : On-Site

Calibration Procedure : SP-CPT-04-04

Received Date : 11 May 2024

Calibration Date : 16 May 2024

Recommend Due Date : 16 May 2025

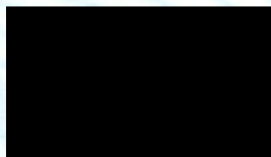
Date of Issue : 17 May 2024

### Method of Calibration

This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Approved by :





ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24050187-3

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Data Acquisition/Switch Unit	34970A	MY44074688	SPR24010142-25	11 Jan 2025

### Traceability

This certification is traceable to the International System of Unit maintained at :  
SP Metrology - SP Metrology system (Thailand) Co.Ltd.



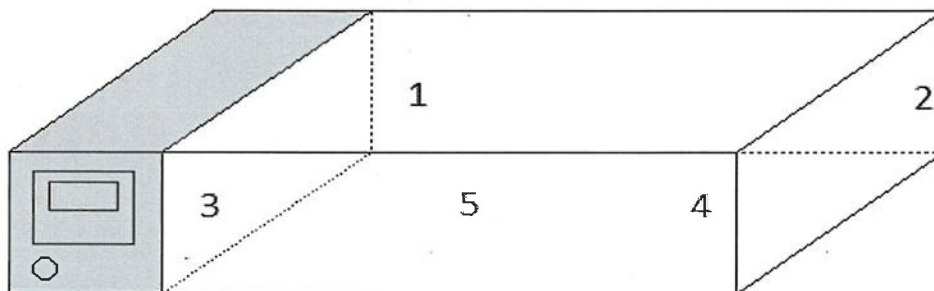
ID LINE : IEC17025



## Result of Calibration

Certificate Number : SPR24050187-3

Page : 3 of 3



### 1. Temperature Accuracy in the Measurement Zone.

Unit : °C

UUC Setting	Measured Temperature (°C) @ Probe No.					Uncertainty ( ± )
	# 1	# 2	# 3	# 4	# 5	
44.5	44.54	44.44	44.50	44.50	44.47	0.19

### 2. Temperature Uniformity, Stability

Unit : °C

UUC Setting	UUC Reading	Temperature Stability	Temperature Uniformity
44.5	44.5	0.07	0.20

#### Note :

The result of calibration was found accurate as show on date and place of calibration only.  
This Certificate is not certified for any commercial transaction.

#### Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2.00$ , providing a level of confidence approximately 95 %

- End of Certificate -





ID LINE : IEC17025



## Certificate of Calibration

Certificate Number : SPR24050187-4

Page : 1 of 3

Customer : TNP ENVIRONMENT CO.,LTD.

332/173 Moo.3, Bang Rak Phatthana, Bang Bua Thong, Nonthaburi  
11110

Equipment Name : Incubator

Manufacturer : BIOBASE

Model : BJPX-M100B

Serial Number : BJPXM1002301016

ID. Number : TNP.LAB.59

### Environmental Conditions

Ambient Temperature :  $25^{\circ}\text{C} \pm 10^{\circ}\text{C}$

Relative Humidity :  $60\% \pm 20\%$

Location of Calibration : On-Site

Calibration Procedure : SP-CPT-04-01

Received Date : 11 May 2024

Calibration Date : 16 May 2024

Recommend Due Date : 16 May 2025

Date of Issue : 17 May 2024

### Method of Calibration

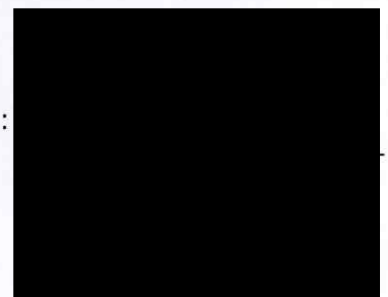
This certifies that the above instrument was calibrated in compliance with the calibration system requirement of ISO/IEC 17025:2017 in accordance with reference procedure. Standards used to perform this calibration are certified by to NIST or equivalent, National metrology institute, Natural physical constants, consensus standards. The result reported herein apply only to the calibration of the item described above as received. Our decision rule is to contact the customer if the item pass and fail calibration when the results include the uncertainties and the customer must determine if the results meets their needs.

The calibration certificate shall not be reproduced except in full, without written approval of SP Metrology System (Thailand).

Calibrated by :



Approved by :







ID LINE : IEC17025



## Calibration Report

Certificate Number : SPR24050187-4

Page : 2 of 3

### Reference Standards

Equipment Name	Model	Serial No.	Certificate No.	Due. Date
Data Acquisition/Switch Unit	34970A	MY44074688	SPR24010142-25	11 Jan 2025

### Traceability

This certification is traceable to the International System of Unit maintained at :  
SP Metrology - SP Metrology system (Thailand) Co.Ltd.



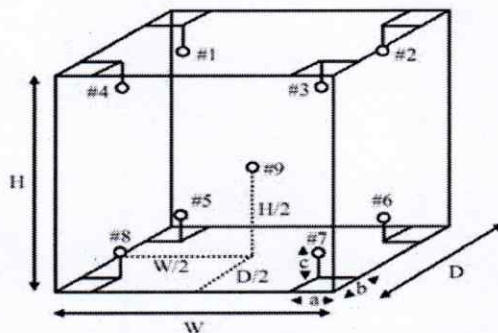
ID LINE : IEC17025



# Result of Calibration

Certificate Number : SPR24050187-4

Page : 3 of 3



Temperature Accuracy in the Measurement Zone.

Unit : °C

UUC Setting	Measured Temperature (°C) @ Probe No. (Probe No. 9 is REF.)									Uncertainty ( ± )
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
35.0	35.20	35.17	35.26	35.22	35.28	35.18	35.24	35.22	35.28	0.19
37.0	37.16	37.24	37.24	37.20	37.23	37.27	37.19	37.23	37.28	0.19
41.5	41.68	41.72	41.77	41.72	41.67	41.74	41.74	41.75	41.79	0.19
42.0	42.22	42.25	42.18	42.28	42.30	42.32	42.27	42.31	42.33	0.19

Temperature Uniformity, Stability, Overall Variation

Unit : °C

UUC Setting	UUC Reading	Temperature Stability	Temperature Uniformity	Overall Variation
35.0	35.0	0.09	0.30	0.30
37.0	37.0	0.11	0.32	0.33
41.5	41.5	0.09	0.26	0.28
42.0	42.0	0.10	0.31	0.36

## Note :

The result of calibration was found accurate as show on date and place of calibration only.  
This Certificate is not certified for any commercial transaction.

## Measurement Uncertainty

The reported uncertainty of measurement is the expanded uncertainty obtained by multiplying the standard uncertainty with the coverage factor  $k = 2$ , providing a level of confidence approximately 95 %

- End of Certificate -

SP-FM-04-15 REV.0



**Certificate No. T/O 670044**

**Date of issue : 15-Mar-2024**

**Equipment Description** : Incubator  
**Equipment Model** : SMART i250-DS  
**Equipment Serial No.** : 0410-0121-0003  
**I.D. No. or Control No.** : -  
**Manufacturer** : Entech Industrial Solution Co.,Ltd.  
**Customer Name** : TNP ENVIRONMENT.CO.,LTD  
**Customer Address** : 332/173 Bang Rak Phatthana Subdistrict, Bang Bua Thong District,  
Nonthaburi 11110  
**Total pages of certificate** : 2 pages  
**Instrument Receiving Date** : 14-Mar-2024  
**Receiving No.** : O-240062  
**Environmental Conditions** : All of the measurement were carried out in the working area  
Temperature : ( 25 ± 15 ) °C  
Humidity : ( 55 ± 30 ) % RH  
Voltage : ( 220 ± 22 ) VAC  
**Calibration Place** : (TNP Lab) 332/173 Bang Rak Phatthana Subdistrict,Bang Bua Thong District,  
Nonthaburi 11110 Thailand

**Calibration Procedure No.** : This instrument was calibrated by comparison of reference radiation source standard according to calibration work instruction no WI-CL-18-C

*The calibration certificate expended uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor k, which for a normal distribution corresponds to a coverage probability of approximately 95%*

*The standard uncertainty of measurement has been determined in accordance with M 3003*

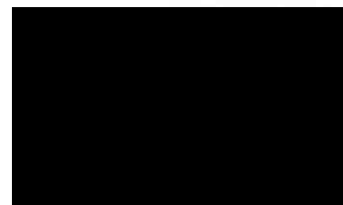
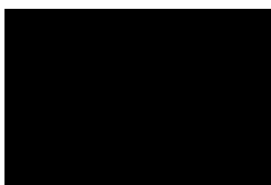
*The expression uncertainty and confidence in measurement.*

*This certificate is applied only to item under test environmental condition.*

*This calibration certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal are not valid and The results relate only to the items tested/calibrated .*

*This calibration certificate documents are traceability to national standards, which realize the unit of measurement according to the International system of units (SI).*

**Date of Calibration** : 14-Mar-2024



**Certificate No. : T/O 670044**

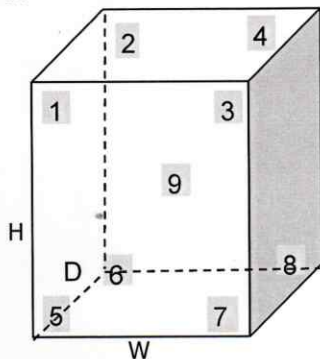
**The Reference Standard Instrument :-**

Instrument	Model	Serial No.	Cert No.	Due date
1) Data logger with RTD Probe	Agilent 34972A	MY49017365	PSL-T 0484-3/67	19-Feb-2025

**Measured room conditions**

<b>Temperature :</b>	Minimum: 23.6 °C	Maximum: 24.2 °C
<b>Humidity :</b>	Minimum: 48.5 %RH	Maximum: 56.9 %RH
<b>Voltage :</b>	Minimum: 220.1 VAC	Maximum: 223.4 VAC
<b>Fresh Air Setting:</b>	off	

**Sensor Position :**



**Working Space of chamber :**

(Inside Dimensions) W x D x H : 500 mm x 480 mm x 1100 mm

**Sensor Installation Details :**

- Sensor Number 1 to 8 installed approximately 50 mm From each wall.
- Sensor Number 9 installed approximately geometric of the chamber.

**Results :** The measurement results of the calibration were reported in the table below.

( \* ) Without adjustment

( ) After adjustment

UUC* Setting	UUC* Reading	Temperature Reading of Standard Sensor								
( °C )	( °C )	Sensor Position								
		1	2	3	4	5	6	7	8	9
20.0	20.0	20.50	19.56	20.31	20.34	20.41	20.28	20.18	20.21	20.30

UUC* Setting	UUC* Reading	Temperature Uniformity	Temperature Stability	Overall Variation	Uncertainty of Measurement	Coverage Factor
( °C )	( °C )	( °C )	( ± °C )	( °C )	( ± °C )	K
20.0	20.0	0.88	0.37	1.33	0.51	2

**UUC\* = Unit Under Calibration**

**Remark :-**

- Temperature reading of Standard Sensors shown in the table were taken from the average of Standard reading at each position.
- Temperature Uniformity was calculated from the difference between the maximum and minimum of actual temperature reading from all reference sensors at the same time.
- Temperature Stability was calculated from the maximum stability of nine positions, and formula of Stability is [ ( Maximum Temperature Value - Minimum Temperature Value ) / 2 ]
- Overall Variation was calculated from the difference between the maximum and minimum measured temperature throughout observation time.

**End of Report**





# THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



## CALIBRATION CERTIFICATE

Certificate No.S2406450S

page 1 of 2

**Customer :** TNP ENVIRONMENT CO., LTD.  
332/173 Moo 3 Tambon Bang Rak Phatthana,  
Amphoe Bang Bua Thong, Nonthaburi 11110

<b>Equipment :</b>	Non-automatic weighing instrument (Electronic instrument)		
<b>Manufacturer :</b>	Sartorius	<b>Order No. :</b>	67S2626-1
<b>Model :</b>	SECURA224-1S	<b>Ambient temperature :</b>	$(27.3 \pm 5.0) ^\circ\text{C}$
<b>Accuracy class :</b>	-	<b>Relative humidity :</b>	$(33.0 \pm 10.0) \%$
<b>Capacity :</b>	220 g	<b>Received date :</b>	17-Jun-2024
<b>Resolution :</b>	0.0001 g	<b>Date of calibration :</b>	17-Jun-2024
<b>Serial No. :</b>	0041305301	<b>Date of issue :</b>	19-Jun-2024
<b>ID No. :</b>	TNP.LAB.31	<b>Condition of the balance :</b>	Good working conditions
<b>Place of calibration :</b>	ห้อง LAB		

### Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

### Condition of reference standard weight

<u>Instrument</u>	<u>Nominal value</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due-date</u>	<u>Density (kg/m<sup>3</sup>)</u>
1 Standard weight set	1 mg to 2 kg	15885+15849	M2310001S	7-Oct-2024	7950

### Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC accredited no. Calibration 0189.

Calibrated By



Approved Signatory :



This calibration certificate may not be reproduced other than in full,  
except with the prior written approval of the head of TCS calibration laboratory.





# THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



## CALIBRATION CERTIFICATE

Certificate No.S2406450S

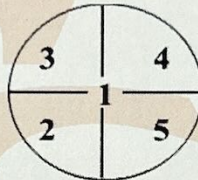
page 2 of 2

### The repeatability of indication

Nominal Value ( g )	Standard Deviation of reading ( g )	Maximum difference between successive reading ( g )	n
200	0.00000	0.0000	5

### The effect of eccentric application of a load on the indication (test load : 100 g)

Position	Balance Reading ( g )
Point 1	100.0000
Point 2	99.9999
Point 3	100.0000
Point 4	100.0000
Point 5	100.0000
Eccentric Value	0.0001



### The error of indication

Nominal Value ( g )	Value of Reference Standard Weight ( g )	Balance Reading ( g )	Correction ( g )	Uncertainty (±) ( g )	k
Unload	0.0000	0.0000	0.0000	0.000082	2.00
0.1	0.1000	0.1000	0.0000	0.000083	2.00
0.5	0.5000	0.5000	0.0000	0.000084	2.00
1	1.0000	1.0000	0.0000	0.000085	2.00
5	5.0000	5.0001	-0.0001	0.000089	2.00
10	10.0000	10.0000	0.0000	0.000093	2.00
20	20.0000	20.0000	0.0000	0.00010	2.00
50	50.0000	50.0000	0.0000	0.00012	2.00
100	99.9999	100.0000	-0.0001	0.00015	2.00
200	199.9999	199.9999	0.0000	0.00026	2.00

Remark : Adjustment, External weight nominal value 200 g, Standard weight of Lab

### Uncertainty of measurement

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor ( $k$ ), which for a normal distribution corresponds to a coverage probability of approximately 95% (confidence level).

**This report will certify of the calibrated equipment only.**

--End--

**Certificate no:** H/T 670338  
**Date of issue :** 21-Mar-24

<b>Instrument description</b>	:	Thermo-Hygrometer
<b>Instrument model</b>	:	Extech 445815
<b>Instrument serial no.</b>	:	PONPE5899554
<b>ID no. or control no.</b>	:	TNP.LAB.21
<b>Manufacturer</b>	:	Extech Instruments
<b>Probe description</b>	:	-
<b>Probe model</b>	:	-
<b>Probe serial</b>	:	-
<b>Customer name</b>	:	TNP ENVIRONMENT CO.,LTD.
<b>Customer address</b>	:	332/173 Moo 3 Tambon Bang Rak Phatthana, Amphoe Bang Bua Thong, Nonthaburi 11110
 <b>Total pages of certificate</b>	:	 2 Pages
<b>Receiving no.</b>	:	L-241004-1
<b>Receiving date.</b>	:	08-Mar-24
<b>Parameter of calibration</b>	:	Temperature Calibration
<b>Condition of UUC.</b>	:	Used
<b>Ambient condition</b>	:	All of the Measurement were carried out the stabilized laboratory Temperature : 23 ± 5 °C Humidity : 55 ± 15 %RH
<b>Calibration place</b>	:	17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Laksi, Bangkok 10210
 <b>Calibration procedure no.</b>	:	 This instrument was calibrated by comparison of indication with the Standard Thermo- hygrometer according to calibration Work Instruction no .WI-CL-11-C

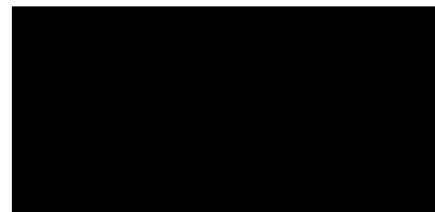
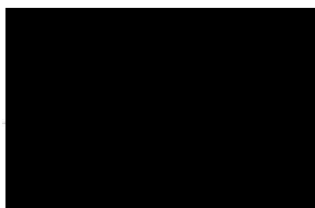
*The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurent Multiplied by coverage factor  $k=2$ , which for a normal distribution corresponds to a coverage probability of approximately 95%.*

*This certificate is applied only to item under test Environmental condition.*

*This Calibration Certificate may not be reporduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid.*

*This calibration certificate documents are tracebility to national standards, which realize measurement according to the International System of Units (SI).*

**Date of calibration** : 20-Mar-24





**Certificate no:** H/T 670338

**Standard references**

Standard	Reference No.	Vendor	Due Date
ARALAB 300ECP,Fitoclima	S2023070040-001	MIT	07-Jul-24
Thermo HygroPalm HP 23-A	SG-H-00579/66	Success Gateway	16-Aug-24

**Measured room conditions**

**Temperature :** 22.1 °C

**Humidity :** 55.9 %RH

**Pressure :** 1019.3 mbar

**Calibration results (Without Adjustment)**

**Reference temperature :** - °C

Parameter of standard	Standard values	Mean of UUC.	Error	Uncertainty (±)
Temperature (°C)	19.97	20.1	0.13	0.50
Temperature (°C)	25.02	25.2	0.18	0.50
Temperature (°C)	29.99	30.2	0.21	0.50

**Remark :** -

**End of Report**





# THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonton 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



## CALIBRATION CERTIFICATE

Certificate No.S2406451S

page 1 of 2

**Customer :** TNP ENVIRONMENT CO., LTD.  
332/173 Moo 3 Tambon Bang Rak Phatthana,  
Amphoe Bang Bua Thong, Nonthaburi 11110

**Equipment :** Non-automatic weighing instrument (Electronic instrument)

**Manufacturer :** Shimadzu

**Model :** AP225WD

**Accuracy class :** -

**Capacity :** 102 g / 220 g

**Resolution :** 0.00001 g / 0.0001 g

**Serial No. :** D316301848

**ID No. :** TNP.LAB.30

**Place of calibration :** ห้อง LAB

**Order No. :** 67S2626-2

**Ambient temperature :**  $(27.2 \pm 5.0) ^\circ\text{C}$

**Relative humidity :**  $(34.0 \pm 10.0) \%$

**Received date :** 17-Jun-2024

**Date of calibration :** 17-Jun-2024

**Date of issue :** 19-Jun-2024

**Condition of the balance :** Good working conditions

### Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

### Condition of reference standard weight

Instrument	Nominal value	Serial No.	Certificate No.	Due-date	Density (kg/m <sup>3</sup> )
1 Standard weight set	1 mg to 2 kg	15885+15849	M2310001S	7-Oct-2024	7950

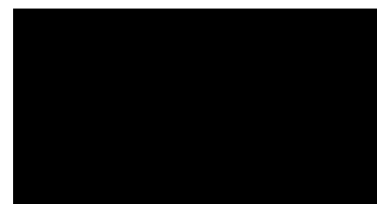
### Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC accredited no. Calibration 0189.

Calibrated By :



Approved Signatory :



This calibration certificate may not be reproduced other than in full,  
except with the prior written approval of the head of TCS calibration laboratory.



# THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



## CALIBRATION CERTIFICATE

Certificate No.S2406451S

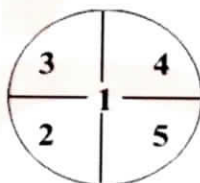
page 2 of 2

### The repeatability of indication

Nominal Value ( g )	Standard Deviation of reading ( g )	Maximum difference between successive reading ( g )	n
100	0.000009	0.00002	5
200	0.00005	0.0001	5

### The effect of eccentric application of a load on the indication (test load : 100 g)

Position	Balance Reading ( g )
Point 1	100.00000
Point 2	100.00002
Point 3	100.00000
Point 4	99.99994
Point 5	99.99995
Eccentric Value	0.00006



### The error of indication

Nominal Value ( g )	Value of Reference Standard Weight ( g )	Balance Reading ( g )	Correction ( g )	Uncertainty (±) ( g )	k
Unload	0.00000	0.00000	0.00000	0.000027	2.65
0.1	0.10000	0.10003	-0.00003	0.000026	2.28
0.5	0.50000	0.50003	-0.00003	0.000029	2.15
1	1.00000	1.00004	-0.00004	0.000031	2.10
5	4.99998	5.00001	-0.00003	0.000041	2.03
10	9.99999	10.00002	-0.00003	0.000047	2.00
20	20.00000	19.99998	+0.00002	0.000060	2.00
50	50.00001	50.00003	-0.00002	0.000074	2.00
100	99.99995	100.00000	-0.00005	0.00012	2.00
200	199.9999	200.0000	-0.0001	0.00026	2.00

Remark : Adjustment, External weight nominal value 100 g, Standard weight of Lab

### Uncertainty of measurement

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor ( $k$ ), which for a normal distribution corresponds to a coverage probability of approximately 95% (confidence level).

**This report will certify of the calibrated equipment only.**

--End--



# THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonton 5 Rd., Sampran, Nakornpatom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



## CALIBRATION CERTIFICATE

Certificate No.S2406450S

page 1 of 2

**Customer :** TNP ENVIRONMENT CO., LTD.  
332/173 Moo 3 Tambon Bang Rak Phatthana,  
Amphoe Bang Bua Thong, Nonthaburi 11110

**Equipment :** Non-automatic weighing instrument (Electronic instrument)

**Manufacturer :** Sartorius **Order No. :** 67S2626-1

**Model :** SECURA224-1S **Ambient temperature :**  $(27.3 \pm 5.0) ^\circ\text{C}$

**Accuracy class :** - **Relative humidity :**  $(33.0 \pm 10.0) \%$

**Capacity :** 220 g **Received date :** 17-Jun-2024

**Resolution :** 0.0001 g **Date of calibration :** 17-Jun-2024

**Serial No. :** 0041305301 **Date of issue :** 19-Jun-2024

**ID No. :** TNP.LAB.31 **Condition of the balance :** Good working conditions

**Place of calibration :** ห้อง LAB

### Calibration method

This instrument was calibrated according to the EURAMET Calibration Guide No. 18.

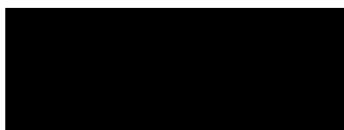
### Condition of reference standard weight

<u>Instrument</u>	<u>Nominal value</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due-date</u>	<u>Density (kg/m<sup>3</sup>)</u>
1 Standard weight set	1 mg to 2 kg	15885+15849	M2310001S	7-Oct-2024	7950

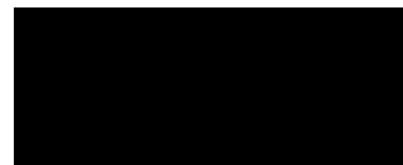
### Traceability of the reference standard weight

This certificate is traceable to SI unit through Mass Calibration Laboratory Thai Calibration Services Co., Ltd., NSC-ONSC accredited no. Calibration 0189.

Calibrated By



Approved Signatory :



This calibration certificate may not be reproduced other than in full,  
except with the prior written approval of the head of TCS calibration laboratory.





# THAI CALIBRATION SERVICES CO., LTD.

19/8 Moo 9 Soi Raiking 30 Puttamonthon 5 Rd., Sampran, Nakhon Pathom 73210

Tel. 0-3439-7682-5 Fax: 0-3439-7687

www.thaical.com E-mail : sale@thaicalibration.com, lab@thaicalibration.com



## CALIBRATION CERTIFICATE

Certificate No.S2406450S

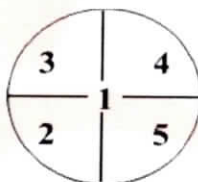
page 2 of 2

### The repeatability of indication

Nominal Value ( g )	Standard Deviation of reading ( g )	Maximum difference between successive reading ( g )	n
200	0.00000	0.0000	5

### The effect of eccentric application of a load on the indication (test load : 100 g)

Position	Balance Reading ( g )
Point 1	100.0000
Point 2	99.9999
Point 3	100.0000
Point 4	100.0000
Point 5	100.0000
Eccentric Value	0.0001



### The error of indication

Nominal Value ( g )	Value of Reference Standard Weight ( g )	Balance Reading ( g )	Correction ( g )	Uncertainty ( $\pm$ ) ( g )	k
Unload	0.0000	0.0000	0.0000	0.000082	2.00
0.1	0.1000	0.1000	0.0000	0.000083	2.00
0.5	0.5000	0.5000	0.0000	0.000084	2.00
1	1.0000	1.0000	0.0000	0.000085	2.00
5	5.0000	5.0001	-0.0001	0.000089	2.00
10	10.0000	10.0000	0.0000	0.000093	2.00
20	20.0000	20.0000	0.0000	0.00010	2.00
50	50.0000	50.0000	0.0000	0.00012	2.00
100	99.9999	100.0000	-0.0001	0.00015	2.00
200	199.9999	199.9999	0.0000	0.00026	2.00

Remark : Adjustment, External weight nominal value 200 g, Standard weight of Lab

### Uncertainty of measurement

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor ( $k$ ), which for a normal distribution corresponds to a coverage probability of approximately 95% (confidence level).

**This report will certify of the calibrated equipment only.**

--End--



CERT.No.: HS-V032E

Certificate of Calibration

Calibration Date : 30 May 24

Submitted by : TNP ENVIRONMENT COMPANY LIMITED.

332/173 Moo. 3, Tambon Bang Rak Phatthana,

Amphoe Bang Bua Thong, Nonthaburi 11110

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 757.00 mmH

Salinity : 0 ppt

Model : YSI 4010-2W

S/N : 22051520

Probe : YSI 4100 BOD

S/N : 22C102711

ID NO. :

Air Temp ref : S/N. F8065C26

Barometric ref : S/N. F8065C26

Water Temp ref : S/N. 11431

Technician : Kittipong M.

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**Calibration Details**


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Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.06	(PASS)	-
Measurement 2 (mg/l)	9.05	(PASS)	-
Measurement 3 (mg/l)	9.04	(PASS)	-
Measurement 4 (mg/l)	9.04	(PASS)	-
Measurement 5 (mg/l)	9.03	(PASS)	-
Measurement 6 (mg/l)	9.03	(PASS)	-
Measurement 7 (mg/l)	9.03	(PASS)	-
Measurement 8 (mg/l)	9.02	(PASS)	-
Measurement 9 (mg/l)	9.02	(PASS)	-
Measurement 10 (mg/l)	9.02	(PASS)	-

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Mean Measurement	9.03	mg/l	-	-
Inaccuracy	0.06	mg/l	-	-

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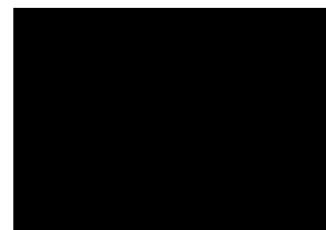
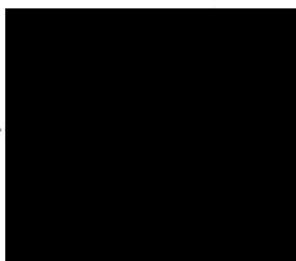
Overall Status (PASS)

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**Manufacturer Specification**

Accuracy = +/- 0.2 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.



CERT.No.: HS-V022D

**Harikul Science Co.,Ltd.**  
 694 Soi Ratchadanivet 24, Pracharatbamphen,  
 Samsaennok, Huaikhwang, Bangkok 10310  
 Tel: 0-2274-2456 Fax: 0-2274-2443  
 Email: info@harikul.com www.harikul.com  
**Certificate of Calibration**

Calibration Date : 10 Apr 24

Submitted by : TNP ENVIRONMENT COMPANY LIMITED  
 332/173 Moo.3, Tambon Bang Rak Phatthana,  
 Amphoe Bang Bua Thong, Nonthaburi 11110

Model : HI 5421  
 S/N : 07210004101  
 Probe : HI 76408W  
 S/N : KC1N32W9P  
 ID NO. :  
 Air Temp ref : S/N. F8065C26  
 Barometric ref : S/N. F8065C26  
 Water Temp ref : S/N. 11430

Avg Room Temp : 20 °C

Avg Water Temp : 20 °C

Air Pressure : 761.00 mmHg

Salinity : 0 ppt

Technician : Kittipong M.

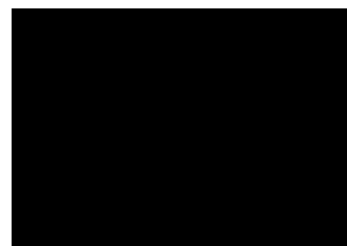
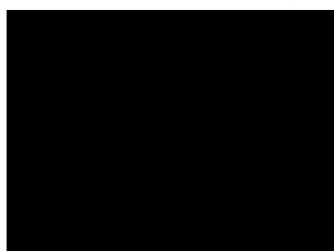
#### Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.08 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.08	(PASS)	-
Measurement 2 (mg/l)	9.07	(PASS)	-
Measurement 3 (mg/l)	9.07	(PASS)	-
Measurement 4 (mg/l)	9.07	(PASS)	-
Measurement 5 (mg/l)	9.07	(PASS)	-
Measurement 6 (mg/l)	9.07	(PASS)	-
Measurement 7 (mg/l)	9.07	(PASS)	-
Measurement 8 (mg/l)	9.07	(PASS)	-
Measurement 9 (mg/l)	9.07	(PASS)	-
Measurement 10 (mg/l)	9.07	(PASS)	-
Mean Measurement	9.07	mg/l	-
Inaccuracy	0.01	mg/l	-
Overall Status	(PASS)		

#### Manufacturer Specification

Accuracy = +/- 0.15 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.





TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)  
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES  
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250  
TEL. 0-2717-3000-29 FAX. 0-2719-9484



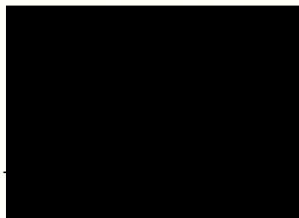
Cert.No.: 23CHO565

Page.: 1 of 3

## Certificate of Calibration

**Equipment :** Spectrophotometer  
**Manufacturer :** Merck  
**Model :** Prove 100  
**Serial No. :** 1904113676  
**ID No. :** S2019025  
**Condition As-Received:** Used Item  
**Received Date :** 21 September 2023  
**Calibration Date :** 21 September 2023  
**Reference :** 2309-0483OC-2  
**Submitted by :** SGS (Thailand) Limited  
1/209, 1/211 Moo 1, Ban Chang,  
Ban Chang, Rayong 21130  
**Calibration Place :** Spectrophotometry Lab  
**Ambient Temperature :** ( 23.8 - 20.9 ) °C (On-Site)  
**Relative Humidity :** ( 50.1 - 50.2 ) % (On-Site)  
**Calibration Procedure :** In - house method :  
CP-OCH4 based on ASTM E 275-01

**Calibrated by :**



**Approved by :**



**Issue Date :**

26 September 2023

**The Uncertainties are for a confidence probability of approximately 95%**

This certificate may not be reproduced other than in full, except with the prior written  
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.





Cert. No. : 23CHO565

Page : 2 of 3

**Condition of calibration result**

1. Reference Standard Material :

<u>Material</u>	<u>Serial No.</u>	<u>Certificate No.</u>	<u>Due date</u>
1. Absorbance Standard set	39130	106269	10 Oct 2024
2. Wavelength Standard set	36730	98330	19 Jan 2024
3. Wavelength Standard set	36730	98331	19 Jan 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certificate is traceable to the International System of Unit maintained through :  
- Starna Scientific Ltd.

4. Spectral BandWidth :        4        nm  
    Scan Speed :               -        nm/min

**Calibration Results : without adjustment**

**Wavelength Accuracy**

<b>Certified Values of Reference Material ( nm )</b>	<b>UUC Reading ( nm )</b>	<b>Uncertainty of Measurement ( ± nm )</b>	<b>Coverage Factor k</b>
418.48	418.5	0.15	2.00
513.70	513.1	0.14	2.00
536.90	536.3	0.14	2.00
637.94	637.6	0.14	2.00
879.70	878.8	0.15	2.00



Cert. No. : 23CHO565

Page : 3 of 3

**Calibration Results : without adjustment**

**Photometric Accuracy**

Wavelength (nm)	Certified Values of Reference Material ( Abs )	UUC Reading ( Abs )	Uncertainty of Measurement ( $\pm$ Abs )	Coverage Factor <i>k</i>
440.0	Zero	0.000	0.0028	2.00
	0.5645	0.563	0.0028	2.00
	0.6988	0.698	0.0028	2.00
	1.0017	1.001	0.0028	2.00
546.1	Zero	0.000	0.0028	2.00
	0.5281	0.527	0.0028	2.00
	0.6962	0.696	0.0028	2.00
	0.9984	0.998	0.0028	2.00
635.0	Zero	0.000	0.0028	2.00
	0.5699	0.569	0.0028	2.00
	0.7606	0.760	0.0028	2.00
	1.0927	1.092	0.0028	2.00

**Remark**

- Each individual filter is measured against the empty filter holder (blank) used to zero the spectrophotometer

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k* , providing a level of confidence of approximately 95 %.

-o0o-



**ARCHEMICA**

## **Certificate of Calibration**

**Aquion RFIC : Anion System (ID#1054)**

**This certificate is to verify that instrument below are calibrated  
by**

**Archemica Lab Co.,Ltd.**

**Aquion**

**S/N 220380025**

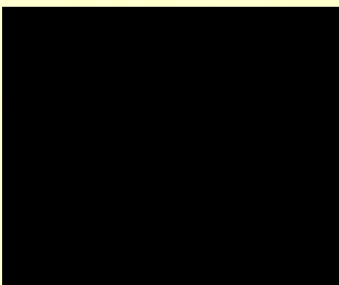
**AS-DV**

**S/N 2203880170**

**For**

**SGS (Thailand) Limited (Rayong Branch).**

**Operator Signature:**



**Date: 15 / Nov / 2023**







## MAINTENANCE AND TEST CERTIFICATE MODEL

### Avio220 Max

<b>Customer :</b> <u>SGS(Thailand)Limited</u> <u>Rayong Branch</u> <b>Address :</b> <u>1/209 , 1/211 Moo 1,</u> <u>T. Banchang, A. Banchang</u> <u>Rayong 21130</u> <b>User Name</b> <span style="background-color: black; color: black;">XXXXXXXXXX</span> <b>Phone:</b> <u>+66(0)38685260-64</u> <b>Email:</b> <u><a href="mailto:saijai.ruangsawat@sgs.com">saijai.ruangsawat@sgs.com</a></u>	<b>Date Tested:</b> <u>January 10, 2024</u> <b>Recommendation Recertification</b> <b>Period</b> <u>6</u> <b>Months</b> <b>Recertification Due:</b> <u>July 10, 2024</u> <b>Date Last Certified:</b> <u>N/A</u> <b>Visit Number:</b> <u>1OF2 W</u> <b>PerkinElmer Phone:</b> <u>02-719-6420 ext 206</u> <b>PerkinElmer Fax:</b> <u>02-318-5597</u>
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#### CONFIGURATION TESTED

<b>MODEL</b>	<b>SERIAL NUMBER</b>	<b>SOFTWARE</b>
<u>AVIO200 MAX</u>	<u>M79S2304111</u>	<u>Syngristix V5</u>
<b>TESTED EQUIPMENT</b>	<b>CALIBRATION NUMBER</b>	<b>EXPIRATION</b>
<u>IPV Methods</u>		
<b>TEST STANDARD USED</b>	<b>PART NUMBER</b>	<b>EXPIRATION DATE</b>
<u>Multielement Standard</u>	<u>N069-1579</u>	<u>30-Dec-24</u>
<u>Instrument Cal. STD4</u>	<u>N930-0221</u>	<u>30-Nov-24</u>
<b>CUSTOMER SUPPLIED</b>	<b>COMMENTS</b>	<b>CUSTOMER INITIALS</b>
<u>2 % HNO3</u>		
<u>10 % HNO3</u>		



**MAINTENANCE AND TEST CERTIFICATE MODEL**  
**Avio220 Max**

**SERIAL NUMBER** M79S2304111**DATE TESTED** January 10, 2024**1. MECHANICAL CHECKS**

A. Inspect and clean all fans and filters.

☐ OK

B. Inspect and replace as necessary, all torch components including the RF coil.

☐ OK

C. Inspect all tubing for sign of clacking or leaking.

☐ OK

D. Adjust water and gas pressure regulator settings.

☐ OK

E. Inspect and leak check pneumatics drawers.

☐ OK

F. Clean the exterior of the instrument.

☐ OK**2. OPTICAL CHECKS**

A. Inspect and clean all optical components.

☐ OK

B. As required, check and replace all purgefilters.

☐ OK

C. Recheck optical alignment.

☐ OK**3. COOLING SYSTEM CHECKS**

A. Perform preventive maintenance on chiller.

☐ OK

B. Flush out the chiller every year.

☐ OK**4. PERFORMANCE CHECKS**

A. Torch View Alignment.

☐ OK

B. Wavelength Calibration.

☐ OK



## MAINTENANCE AND TEST CERTIFICATE MODEL

### Avio220 Max

SERIAL NUMBER <u>M79S2304111</u>		DATE TESTED <u>January 10, 2024</u>	
PARAMETER	SPECIFICATION		FINAL VALUE
Spectral Resolution : UV			
As 193.696 nm	≤ 0.009 nm	<u>0.00864</u> nm	
Ni 231.604 nm	≤ 0.011 nm	<u>0.01009</u> nm	
Ni 341.476 nm	≤ 0.015 nm	<u>0.01169</u> nm	
Spectral Resolution : VIS			
Ba 455.403 nm	≤ 0.020 nm	<u>0.01776</u> nm	
Precision			
Zn 206.200 nm	% RSD ≤ 1.0 %	<u>0.28</u> %	
Mg 280.271 nm	% RSD ≤ 1.0 %	<u>0.73</u> %	
Mg 285.213 nm	% RSD ≤ 1.0 %	<u>0.61</u> %	
Ba 455.403 nm	% RSD ≤ 1.0 %	<u>0.54</u> %	
Detection Limits : Axial			
Tl 190.801 nm	3(sd)	<u>1.52</u> ppb	
As 193.696 nm	3(sd)	<u>1.4</u> ppb	
Se 196.026 nm	3(sd)	<u>1.53</u> ppb	
Pb 220.353 nm	3(sd)	<u>1.72</u> ppb	
Detection Limits : Radial			
As 193.696 nm	3(sd)	<u>1.69</u> ppb	
Zn 213.857 nm	3(sd)	<u>0.42</u> ppb	
Mn 257.610 nm	3(sd)	<u>0.1</u> ppb	
La 379.478 nm	3(sd)	<u>0.61</u> ppb	
Ba 455.403 nm	3(sd)	<u>0.13</u> ppb	
Ba 493.408 nm	3(sd)	<u>0.1</u> ppb	
BEC : Axial (IB X 1000)/(IS-IB)			
Mn 257.610 nm	≤ 30 ppb	<u>7.83</u> ppb	
BEC : Radial (IB X 1000)/(IS-IB)			
Mn 257.610 nm	≤ 30 ppb	<u>17.57</u> ppb	





**MAINTENANCE AND TEST CERTIFICATE MODEL**  
**Avio220 Max**

**SERIAL NUMBER** M79S2304111

**DATE TESTED** January 10, 2024

**Remarks :**

Commissioning follow as commissioning performance sheets.

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This is to certify that the above tests have been performed and the configuration tested



meets



does not meet

the PerkinElmer Specifications listed on this certificate.

This certificate does not modify PerkinElmer's standard terms and condition of sale,  
including warranty terms.

**Service Department PerkinElmer Ltd.**

Customer Service Engineer: \_\_\_\_\_

(



## Verification COD Reactor

Equipment Name	Dri-Block Heater-Digital	Temperature Ver.	150±2 °C
Serial No.	000827-A	Model	DB 200/3
Reference Standard	Thermocouple Type K	Certificate No.	21/4272
Calibration Date	10/03/2023	Next Cal. Date	10/03/2024

<b>Left</b>											
Hole 1				Hole 2				Hole 3			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.1	-0.36	150.7	1	150.6	-0.36	150.2	1	151.4	-0.36	151.0
2	150.8	-0.36	150.4	2	151.7	-0.36	151.3	2	151.3	-0.36	150.9
3	151.2	-0.36	150.8	3	151.1	-0.36	150.7	3	151.7	-0.36	151.3
		Mean	150.67			Mean	150.77			Mean	151.11
		SD	0.208			SD	0.551			SD	0.208
		%RSD	0.138			%RSD	0.365			%RSD	0.138
Hole 4				Hole 5				Hole 6			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.7	-0.36	151.3	1	150.5	-0.36	150.1	1	151.5	-0.36	151.1
2	151.6	-0.36	151.2	2	151.3	-0.36	150.9	2	151.4	-0.36	151.0
3	151.5	-0.36	151.1	3	150.6	-0.36	150.2	3	150.5	-0.36	150.1
		Mean	151.24			Mean	150.44			Mean	150.77
		SD	0.100			SD	0.436			SD	0.551
		%RSD	0.066			%RSD	0.290			%RSD	0.365
Hole 7				Hole 8				Hole 9			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.3	-0.36	150.9	1	151.7	-0.36	151.3	1	150.5	-0.36	150.1
2	151.0	-0.36	150.6	2	150.5	-0.36	150.1	2	151.2	-0.36	150.8
3	151.3	-0.36	150.9	3	151.4	-0.36	151.0	3	150.8	-0.36	150.4
		Mean	150.84			Mean	150.84			Mean	150.47
		SD	0.173			SD	0.624			SD	0.351
		%RSD	0.115			%RSD	0.414			%RSD	0.233
Hole 10				Hole 11				Hole 12			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.6	-0.36	151.2	1	151.5	-0.36	151.1	1	150.7	-0.36	150.3
2	151.6	-0.36	151.2	2	151.2	-0.36	150.8	2	151.6	-0.36	151.2
3	150.8	-0.36	150.4	3	151.5	-0.36	151.1	3	151.2	-0.36	150.8
		Mean	150.97			Mean	151.04			Mean	150.81
		SD	0.462			SD	0.173			SD	0.451
		%RSD	0.306			%RSD	0.115			%RSD	0.299

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## Verification COD Reactor

Equipment Name      Dri-Block Heater Digital  
 Serial No.              000827-A  
 Reference Standard    Thermocouple Type K  
 Calibration Date       10/03/2023

Temperature Ver        150±2 °C  
 Model                    DB 200/3  
 Certificate No.         21/4272  
 Next Cal. Date         10/03/2024

**Middle**

Hole 1				Hole 2				Hole 3			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.2	-0.36	150.8	1	150.7	-0.36	150.3	1	151.1	-0.36	150.7
2	151.5	-0.36	151.1	2	151.7	-0.36	151.3	2	151.6	-0.36	151.2
3	151.6	-0.36	151.2	3	150.8	-0.36	150.4	3	150.9	-0.36	150.5
		Mean	151.07			Mean	150.71			Mean	150.84
		SD	0.208			SD	0.551			SD	0.361
		%RSD	0.138			%RSD	0.365			%RSD	0.239

Hole 4				Hole 5				Hole 6			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.5	-0.36	151.1	1	151.6	-0.36	151.2	1	150.5	-0.36	150.1
2	150.7	-0.36	150.3	2	151.2	-0.36	150.8	2	150.6	-0.36	150.2
3	151.6	-0.36	151.2	3	151.2	-0.36	150.8	3	151.2	-0.36	150.8
		Mean	150.91			Mean	150.97			Mean	150.41
		SD	0.493			SD	0.231			SD	0.379
		%RSD	0.327			%RSD	0.153			%RSD	0.252

Hole 7				Hole 8				Hole 9			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151.5	-0.36	151.1	1	151.5	-0.36	151.1	1	151.2	-0.36	150.8
2	150.5	-0.36	150.1	2	151.7	-0.36	151.3	2	150.9	-0.36	150.5
3	150.8	-0.36	150.4	3	151.1	-0.36	150.7	3	151.4	-0.36	151.0
		Mean	150.57			Mean	151.07			Mean	150.81
		SD	0.513			SD	0.306			SD	0.252
		%RSD	0.341			%RSD	0.202			%RSD	0.167

Hole 10				Hole 11				Hole 12			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	151	-0.36	150.6	1	151.5	-0.36	151.1	1	151.2	-0.36	150.8
2	150.6	-0.36	150.2	2	150.6	-0.36	150.2	2	150.5	-0.36	150.1
3	151.5	-0.36	151.1	3	151.0	-0.36	150.6	3	151.1	-0.36	150.7
		Mean	150.67			Mean	150.67			Mean	150.57
		SD	0.451			SD	0.451			SD	0.379
		%RSD	0.299			%RSD	0.299			%RSD	0.251

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## Verification COD Reactor

Equipment Name      Dri-Block Heater Digital  
 Serial No.              000827/A  
 Reference Standard    Thermocouple Type K  
 Calibration Date       10/03/2023

Temperature Ver         $150 \pm 2^{\circ}\text{C}$   
 Model                    DB 200/3  
 Certificate No.         21/4272  
 Next Cal. Date         10/03/2024

Right

Hole 1				Hole 2				Hole 3			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	149.9	-0.36	149.5	1	150.3	-0.36	149.9	1	151.0	-0.36	150.6
2	151.1	-0.36	150.7	2	151.0	-0.36	150.6	2	151.0	-0.36	150.6
3	150.9	-0.36	150.5	3	149.9	-0.36	149.5	3	150.4	-0.36	150.0
		Mean	150.27			Mean	150.04			Mean	150.44
		SD	0.643			SD	0.557			SD	0.346
		%RSD	0.428			%RSD	0.371			%RSD	0.230

Hole 4				Hole 5				Hole 6			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	150.8	-0.36	150.4	1	150.0	-0.36	149.6	1	150.5	-0.36	150.1
2	151.0	-0.36	150.6	2	150.0	-0.36	149.6	2	150.8	-0.36	150.4
3	150.9	-0.36	150.5	3	150.7	-0.36	150.3	3	149.8	-0.36	149.4
		Mean	150.54			Mean	149.87			Mean	150.01
		SD	0.100			SD	0.404			SD	0.513
		%RSD	0.066			%RSD	0.270			%RSD	0.342

Hole 7				Hole 8				Hole 9			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	150.8	-0.36	150.4	1	151.1	-0.36	150.7	1	150.2	-0.36	149.8
2	150.9	-0.36	150.5	2	150.7	-0.36	150.3	2	150.2	-0.36	149.8
3	151.0	-0.36	150.6	3	151.1	-0.36	150.7	3	149.9	-0.36	149.5
		Mean	150.54			Mean	150.61			Mean	149.74
		SD	0.100			SD	0.231			SD	0.173
		%RSD	0.066			%RSD	0.153			%RSD	0.116

Hole 10				Hole 11				Hole 12			
NO.	Result			NO.	Result			NO.	Result		
	temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.		temp. °C	Corr.	temp+Corr.
1	150.6	-0.36	150.2	1	150.5	-0.36	150.1	1	150.9	-0.36	150.5
2	150.5	-0.36	150.1	2	150.9	-0.36	150.5	2	150.0	-0.36	149.6
3	149.9	-0.36	149.5	3	151.1	-0.36	150.7	3	150.5	-0.36	150.1
		Mean	149.97			Mean	150.47			Mean	150.11
		SD	0.379			SD	0.306			SD	0.451
		%RSD	0.252			%RSD	0.203			%RSD	0.300

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## สรุปผลการ Verify

ปรับอุณหภูมิ 154.0 °C แต่คนควบคุมอุณหภูมิ 150 ± 2 °C ทุกครั้ง

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



## CERTIFICATE OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM14102/UM14102  
CLID. NO. : 252100393  
JOB CONTROL NO. : 241101116709  
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

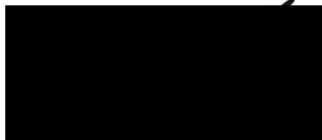
CUSTOMER : TNP ENVIRONMENT CO., LTD.  
332/173 MOO 3 TAMBON BANG RAK PHATTANA,  
AMPHOE BANG BUA THONG, NONTABURI 11110

DATE OF RECEIVED : 01 November 2024

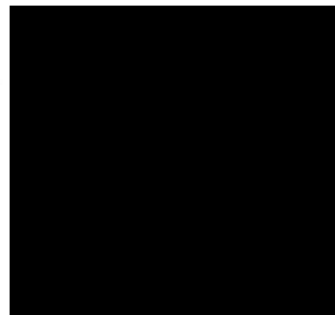
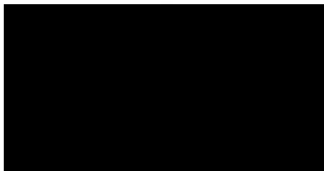
DATE OF ISSUED : 06 November 2024

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Calibrated By :



Approved By :



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the  
International System of Units (SI)

Certificate No. Q24116709

F3-011-05/12-23

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## REPORT OF CALIBRATION

### FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM14102/UM14102  
DATE OF CALIBRATION : 04 November 2024

#### ENVIRONMENT CONDITIONS :

Temperature :  $(23 \pm 2) ^\circ\text{C}$

Relative Humidity :  $(55 \pm 15) \% \text{RH}$

#### PROCEDURE USED :

This instrument was calibrated under procedure No. CLC-CPEE-08 based on ISO 16063-21 as calibration guideline.

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter, Vibration Calibrator which maintained by the Calibration Laboratory Co., Ltd.

#### REFERENCE STANDARD USED :

1. Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
2. Digital Multimeter, Hewlett Packard Model 34401A S/N. 3146A75935.
3. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.

#### TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-24, Due Date 19 July 2025.
2. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0130-23, Due Date 29 November 2024.
3. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0050/24 , Due Date 13 May 2025 .

#### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2,00$  which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q24116709

F3-011-05/12-23

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**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

## CALIBRATION DATA

### 1. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
( mm/s )	( frequency )		( mm/s )	( mm/s )	( mm/s )	± ( % of rdg. )
10	80 Hz	peak	10.000	10.097	-0.097	1.5
20	80 Hz		20.000	20.188	-0.188	1.5
30	80 Hz		30.000	30.256	-0.256	1.5
40	80 Hz		40.000	40.365	-0.365	1.5
50	80 Hz		50.000	50.421	-0.421	1.5

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 2 of 67



## CALIBRATION DATA

### \*2. FREQUENCY RESULT

STD Applied ( Hz )	DUC Reading ( Hz )	Correction ( Hz )	Uncertainty $\pm$ ( Hz )
50	50	0	0.6
80	79	+1	0.6
100	100	0	0.6

Note. \* means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

**This report is valid for the above stated instrument/s only.**

### End of Certificate ###

Certificate No. Q24116709

F3-011-05/12-23

page 4 of 4



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## CERTIFICATE OF CALIBRATION FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM19244/UM19244  
CLID. NO. : 252402113  
JOB CONTROL NO. : 240919100992  
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

CUSTOMER : TNP ENVIRONMENT CO., LTD.  
332/173 MOO 3 TAMBON BANG RAK PHATTANA,  
AMPHOE BANG BUA THONG, NONTHABURI 11110

DATE OF RECEIVED : 19 September 2024

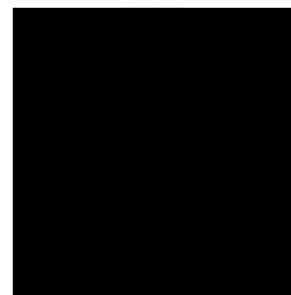
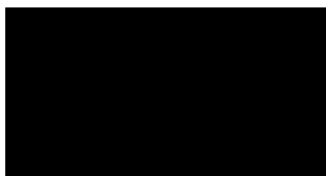
DATE OF ISSUED : 28 September 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By :



Approved By :



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the  
International System of Units (SI)

Certificate No. Q24100992

F3-011-05/12-23

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## REPORT OF CALIBRATION FOR

NOMENCLATURE : VIBRATION METER  
MANUFACTURER : INSTANTEL  
MODEL / TYPE : 721A2601/721A3301  
SERIAL NO. : UM19244/UM19244  
DATE OF CALIBRATION : 26 September 2024

### ENVIRONMENT CONDITIONS :

Temperature :  $(23 \pm 2) ^\circ\text{C}$

Relative Humidity :  $(55 \pm 15) \% \text{RH}$

### PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter, Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

### REFERENCE STANDARD USED :

1. Digital Multimeter, Hewlett Packard Model 34401A S/N. 3146A75935.
2. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2626 S/N. 705491, 1741406.

### TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0130-23, Due Date 29 November 2024.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0050/24 , Due Date 13 May 2025 .
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0053-23, Due Date 12 October 2024.

### UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor  $k = 2,00$  which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q24100992

F3-011-05/12-23

page 2 of 4



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# CALIBRATION LABORATORY Co., LTD.

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



**CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION**

**MEASUREMENT RESULTS : ( X ) without adjustment ( ) adjustment**

## CALIBRATION DATA

### 1. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
( mm/s )	( frequency )		( mm/s )	( mm/s )	( mm/s )	± ( % of rdg. )
10	80 Hz	peak	10.000	10.089	-0.089	1.6
20	80 Hz		20.000	20.156	-0.156	1.1
30	80 Hz		30.000	30.196	-0.196	1.0
40	80 Hz		40.000	40.256	-0.256	0.9
50	80 Hz		50.000	50.311	-0.311	0.9

Note. The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 2 of 67

Certificate No. Q24100992

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## CALIBRATION DATA

### \*2. FREQUENCY RESULT

STD Applied ( Hz )	DUC Reading ( Hz )	Correction ( Hz )	Uncertainty $\pm$ ( Hz )
50	50	0	0.8
80	80	0	0.8
100	100	0	0.8

Note. \* means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

**This report is valid for the above stated instrument/s only.**

### End of Certificate ###

Certificate No. Q24100992

F3-011-05/12-23

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